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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/840,235	04/24/2001	Penny G. Warren	N.C.82,413	3487

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EXAMINER

LAROSE, COLIN M

ART UNIT PAPER NUMBER

2624

DATE MAILED: 05/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/840,235

Applicant(s)

WARREN ET AL.

Examiner

Colin M. LaRose

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 29 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 24-40 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 24-40 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 29 March 2006 has been entered (Applicant's remarks were filed on 27 June 2005).

### ***Response to Amendments and Arguments***

2. Applicant has amended independent claims 24 and 33 to denote that "at least three image-acquiring sensor areas are located on one or more imaging sensors," rather than two, as previously claimed.

This amendment is sufficient to overcome the previous § 102(b) rejections in view of Waxman (5,555,324). However, the claims are considered an obvious variant of Waxman and Watkins (6,597,807), as explained below. [Watkins was previously cited on a PTO-892 by the Examiner.] Whereas Waxman utilizes two "image-acquiring sensor areas" corresponding to different spectral bands, Watkins utilizes three such sensor areas. As shown in figure 1 of Watkins, each of a pair of stereo cameras contains three different "sensor areas" that are sensitive to different spectral bands. The images obtained by the three sensors on each camera are assigned RGB color codes and fused together into a single composite image, thereby producing stereo RGB composite images to be displayed e.g. to the left and right eyes of a viewer.

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It would have been obvious to utilize three different spectral sensors in a multi-spectral imaging system, instead of two as taught by Waxman, for the reasons provided below.

### ***Claim Objections***

3. Claim 30 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claim 30 provides for "one or more additional sensors." This does not further limit parent claim 24, which calls for the boundless, "one or more imaging sensors." Only if claim 24 were changed to recite a discreet or maximal number of sensors would claim 30 be further limiting.

4. Claim 31 is objected to under 37 CFR 1.75(c) for improperly referring to "said sensors" in claim 24, which provides that there may only be one sensor. Suggestion correction is to change "said sensors comprise" to -- said one or more imaging sensors each comprise --.

### ***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 24-28 and 30-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,555,324 by Waxman et al. ("Waxman") in view of U.S. Patent 6,597,807 by Watkins et al. ("Watkins") and U.S. Patent 5,581,638 by Givens et al. ("Givens").

Regarding claims 24 and 33, Waxman discloses an image processing apparatus/method (figure 4) for processing imaging data in a plurality of spectral bands and fusing the data into a color image, comprising:

two imaging sensors (cameras 310 and 312);

at least two image-acquiring sensor areas located on said two imaging sensors (i.e. a first sensor area on camera 310 and a second sensor area on camera 312), wherein each said sensor is sensitive to a different spectral band than at least one other of said sensor areas (sensor area for camera 310 is sensitive to visible-near IR spectral band, and sensor area for camera 312 is sensitive to long-wave IR spectral band) and generates an image output representative of an acquired image in the spectral band to which the sensor area is sensitive (sensors for cameras 310 and 312 produce visible/near IR and long-wave IR images, respectively);

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a frame grabber connected to said imaging sensors (A/D converters 328 digitize and transmit frames of image data to the processors);

a general purpose computer (processor 330 is a general-purpose computer that performs various functions) connected to said imaging sensors for executing in real time:

a registration algorithm registering said image outputs (vision processor 392 contains processors 360 and 362 (see fig. 6), which execute algorithms registering and generally preprocessing the image outputs); and

a color fusion algorithm for combining said image outputs into a single image (fig. 6 shows the execution of the algorithm for combining the VIS-NIR and LWIR image signals into a single RGB image).

Waxman does not expressly teach that there are three image-acquiring sensor areas, as claimed. As shown in figure 4, Waxman utilizes a pair of image sensors, wherein each sensor is sensitive to a different spectral band. [The cameras share the same field of view and are focused along a common axis - col. 10/42-45.]

Therefore, in Waxman's system, there are only two "image-acquiring sensor areas \* \* \* sensitive to a different spectral band," as claimed.

Watkins discloses an image fusion system (figure 1) that is similar to Waxman's system. Like Waxman, Watkins utilizes cameras that are sensitive to more than one spectral band. The different spectral images captured from each sensor are fused into a single image according to RGB color codes. Then, the fused images of each stereo camera are displayed to e.g. the left and right eyes of a user - see col. 4/35-48.

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But whereas Waxman's cameras are sensitive in only two different spectral bands (VIS-NIR & LWIR), Watkins's cameras are each sensitive to three spectral bands (Near-IR, Mid-IR, and Far-IR). Watkins's sensors thus contain "three image-acquiring sensor areas \* \* \* sensitive to a different spectral band."

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Waxman by Watkins to achieve the claimed invention by employing three image-acquiring sensor areas sensitive to different spectral bands, as taught by Watkins. Watkins teaches that acquiring three different spectral images and then fusing those images together according to color for display to a user provides a representation of a viewed scene that capitalizes on the properties of the human visual system to offer enhanced target recognition capabilities. Specifically, capturing and displaying three different spectral images in the manner taught by Watkins takes advantage of a human's preattentive vision characteristics to allow objects in a scene to be identified more easily. See column 3/25-53 and column 4/48-67.

While Waxman teaches that the registration algorithm performed by preprocessors 360 and 362 compensates for alignment, distortion errors, and the like (see column 13/37-40), Waxman does not expressly teach that the algorithm involves "scaling the image outputs," as claimed.

Givens discloses a method for autonomous image registration for aligning two images having a common coverage area, such as those images obtained by Waxman in figure 6. In particular, Givens teaches that the process of registering two images having a common coverage

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area conventionally involves scaling down the images (see column 5, lines 36-45: the images are resampled at 1/8X magnification and then minified at a magnification of 1/32X magnification).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Waxman and Watkins by Givens to achieve the claimed invention by including a scaling operation of the images in the registration algorithm, as claimed, since Givens teaches that scaling common-coverage area images to be registered was a conventional image processing technique employed during an image registration process in order to reduce the images to a very low resolution (see column 5/36-45). The registration operations subsequently performed on the images reduced by 32X would then be much less computationally intensive than if those operations were performed on the full resolution images.

Regarding claim 25 and 34, Waxman discloses a screen display to display the outputs (332, figure 4).

Regarding claims 26 and 35, Waxman discloses an operator interface for allowing operator input in processing of said image outputs (column 15, lines 33-37: user input is allowed for selecting a color mapping).

Regarding claims 27 and 36, the combination of Waxman and Watkins teaches the color fusion algorithm is simple color fusion whereby each sensor area image output is separately assigned to a different color based on wavelength (Waxman, figure 6: colors are assigned on the basis of the wavelegnth being VIS-NIR or LWIR; and Watkins teaches that for each of the three different spectral images, RGB color codes are assigned based on the wavelengths thereof to create a single fused color image).



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Regarding claims 28 and 37, the combination of Waxman and Watkins teaches the color fusion algorithm is based on principle component color fusion whereby said sensor area outputs are fused into one image (Waxman, column 3, lines 28-43: the assigned RGB color codes are converted to the HVS color space to form a single, color-fused image).

Regarding claim 30, the combination of Waxman and Watkins teaches using an additional sensor having some of the sensors areas (Watkins's camera 310, in addition to camera 312; and Watkins's stereo cameras).

Regarding claims 31 and 38, Watkins teaches that each sensor comprises three sensors, each configured to map its image to an associated color channel (see figure 1), and a fusion algorithm is configured to combine the color channels into a color image (see figure 1: the color channels for each stereo camera are combined into right and left composite video signals).

Regarding claims 32 and 39, Watkins teaches the three sensors are sensitive to NIR, MWIR, and LWIR spectral bands (see figure 1).

Regarding claim 40, the combination of Waxman and Watkins teaches the processing and fusing of said image occurs in real time (Waxman, column 11, lines 1-4).

### ***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,555,324 by Waxman et al. ("Waxman") in view of U.S. Patent 6,597,807 by Watkins et al. ("Watkins") and U.S. Patent 5,581,638 by Givens et al. ("Givens"), as applied to claim 28, and further in view of U.S. Patent 4,533,938 by Hurst.

Regarding claim 29, Waxman discloses performing a PCCF algorithm (i.e. converting RGB to HVS values) in order to perform "desirable color manipulations" within the HVS space (column 15, lines 5-21). Processor 520, figure 10, is capable of performing color transformations to produce desirable effects on the image to be displayed.

Waxman does not disclose desaturating the HVS image, since Waxman's shunting algorithms produce images that are typically unsaturated (column 8, lines 48-51). However, should the final color image be saturated, it would have obvious to utilize processor 520 to desaturate the HVS image using any of the well-known desaturation techniques in order to enhance the image for display.

For example, Hurst discloses an image processing system wherein a desaturation signal is added to the image signal when a hue value is modified (see Abstract). This desaturation signal

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is added in order to minimize the changes in saturation when the hue is modified. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Waxman by Hurst to desaturate the fused output image, as claimed, since Waxman teaches that a user to allowed to adjust the hue of the output image, and Hurst teaches that, as part of the logistics of adjusting the hue of an image signal, it is advantageous to desaturate the image so that changes in saturation attributable to the changing of the hue are minimized (see Abstract and column 1, lines 11-28 and column 2, lines 30-38).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colin M. LaRose whose telephone number is (571) 272-7423. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu, can be reached on (571) 272-7429. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the TC 2600 Customer Service Office whose telephone number is (571) 272-2600.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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A handwritten signature in black ink, appearing to read 'Colin LaRose', with a stylized, flowing script.

Colin LaRose  
Group Art Unit 2624  
30 April 2006